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RESEARCH PAPER

Assessment of the Chemical Constituents of Drinking Water Used by Diabetic Patients

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ABSTRACT : Water is a very important element for people survival. For diabetic people who have no enough water levels supplied to the body, it can make the situation worse. Blood concentration and blood sugar will be elevated due to dehydration and getting diabetes and heart disease. The constituents of water also influence the diabetes. The present study of research was attempted to analyze chemical constituents *i.e.* pH, total hardness, chloride, alkalinity, fluoride and nitrate in drinking water used by diabetic subjects. Mean, standard deviation and T test were calculated for comparing water quality in RO, boring and tap water consumed by diabetic subjects. Results shows that pH, chloride and alkalinity were in safe level and total hardness, fluoride and nitrate were at unsafe level as compared with WHO standards. In case of total hardness, it is beneficial for diabetic subjects because calcium and magnesium present in water it help to prevent coronary heart disease (CHD) and diabetes. Alkaline pH of water is useful for improvement in health of diabetic subjects.

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Diabetes mellitus is considered to be one of the most lethal of the life style diseases today. It is killing a large number of the world population every year, and the number is only going up each year. Awareness and modification in the life style seem to be the only way to control this silent monster, but there is very less effort going on in that area. Long considered most cases of diabetes a life style disease, associated with poor diet and a lack of exercise, but now researchers have found that other factors beyond heredity may also play a role, specifically environmental ones (Longnecker and Danial, 2001).

Water is a very important element for people survival. For diabetes people who have no enough water levels supplied to the body, it can make the situation worse. Blood concentration and blood sugar will be elevated due to dehydration and getting diabetes and heart disease .The constituents of water also influence the diabetes.

Inorganic arsenic may contribute to diabetes by interfering with insulin sensitivity. When the body's cells are exposed to both insulin and arsenic, they absorb less blood glucose than when exposed to insulin alone and of course, impaired ability to manage glucose is a hallmark of diabetes. Inorganic arsenic may also contribute to diabetes by encouraging inflammation

(Navas and Acien, 2008).

A strong association between acidity in drinking water and risk of type 1 diabetes and a tendency that higher tap water concentration of zinc was associated with lower risk of type 1 diabetes. These associations were independent of presence of the highly protective HLA-DQB1*0602 allele and possible confounders. Acid water in itself is unlikely to be causally related to type 1 diabetes, but may be a marker of some other factor. Acidity of ground water is associated with concentration of a number of minerals. Low groundwater zinc concentration could contribute to zinc deficiency, which again may affect immune function or otherwise be diabetogenic (Stane *et al.*, 2002).

When acid waste accumulates in our body, our cells are not able to function properly. When the cells don't function properly, the organs and body's chemistry don't work properly. This includes the organs and enzymes chemicals that regulate blood sugar, which in turn provide energy to the cells. Enzymes and hormones run the body and they are both pH sensitive; especially enzymes. Without blood sugar regulation, the body can become diabetic. The longer a person waits to reduce the acid levels within their body, which will result in a study decline of health. Often, it will take years before symptoms of complications become noticeable. If you have diabetes or symptoms of diabetes, chances are your body pH level is already too acidic and in a state of metabolic acidosis (Zhao *et al.*, 2011).

Diabetes is the deficiency of calcium ions in our body reduces insulin production. It may significantly increase blood acidity. Excessive protein buildup can damage the pancreatic function. This is where Diabetes and Alkalinity comes into play. Alkaline water prevents excess protein buildup and improves the condition of a patient. Higher nitrate levels in drinking water have sometimes been associated with an increased incidence of type 1 diabetes. Diabetic individuals will often have higher than normal water intake and consequently, will have higher than normal fluoride intake for a given concentration of fluoride in drinking water. Role of fluoride exposure in the development of impaired glucose metabolism or diabetes is potentially significant (Gupta *et al*., 2003).

Therefore, the study was planned to analyze chemical constituents of pH, total hardness, chloride, alkalinity, fluoride and nitrate in drinking water used by diabetic subjects. The objective of the study was to assess the quality of drinking water by chemical analysis, consumed by the diabetic patients and to compare the different parameter of drinking water with WHO standard for safe drinking water.

RESEARCH METHODOLOGY

The study was conducted in Bhilwara district of Rajasthan State. Fifty diabetic subjects (Male and Female) were selected by purposive sampling technique.

Water consumed by diabetic subjects at home *i.e.* RO, boring and tap water were taken as the samples. The samples were analyzed in the laboratory using standard methods at the department of food and nutrition, S.D.M. College, and also at water supply department Bhilwara. The samples were analyzed for pH, total hardness, chloride, alkalinity, fluoride and nitrate content. pH were analyzed by pH meter, total hardness, chloride and alkalinity were analyzed by using titration method, and fluoride and nitrate were assessed using charts.

RESULTS AND DISCUSSION

The result of the study revealed (Table 1) that the mean value of pH of tap water consumed by diabetic people was 8.1±0.35, which was higher than RO (7.325±1.07) and boring water (7.5±0.65) .The t-value when calculated for the mean difference of the pH values, it was observed that the mean difference of pH of RO and tap water was significant.

The mean values of total hardness of boring water was 542±10.95 which was higher than RO (170.5±132.8) and tap water (204±71.6). The t-values observed for mean difference between RO, boring and tap water for total hardness was non-significant.

Mean±SD values of chloride was higher in boring water (160±151.8) than RO and tap water (9.5±6.32 and 148.4±59.13). The difference was found to be non-significant.

The mean value of tap water for alkalinity (218.8±95.4) was higher as compare to RO and boring water (48.5±143.9 and 80±58.7). There was significant difference between boring and tap water and non-significant between RO and boring water and RO and tap water.

Mean value of fluoride content in boring water was higher than RO and tap water consumed by diabetic

people (3.6±1.9, 2.8±1.9 and 2±1.59). The t-value observed was non-significant.

The mean value of nitrate of RO and tap water was almost similar 23.25±14.71 and was higher than boring water content 8.4±10.43. The t-value proved the mean difference to be non-significant.

Comparison of different parameters of drinking water with WHO standards :

Comparison of different parameters shows that .

pH :

The permissible limit of pH as recommended by WHO is 7.0-9.5. All the three source of water *i.e*. RO water, boring water and tap water consumed by diabetic patient were having the pH range of 7.325, 7.5 and 8.1 and all were in the safe limit (Table 2).

Total hardness :

The mean total hardness of boring water is 542 mg/lit. Which is higher than the hardness of RO water or tap water was 170.5 mg/lit. or 204 mg/lit. Which were above the recommended value. Yang *et al*. (2009) examined the relationship between death from cerabrovascular disease and the levels of magnesium and calcium in drinking water of Taiwan. The results from

Table 1: Comparison of RO water, boring water and tap water consumed by diabetic patient

Parameters	RO water Mean±SD	Boring water Mean±SD	Tap water Mean±SD	T value
pH	7.325±1.07	7.5±0.65	8.1±0.35	RO/Boring 1.519NS
				Boring/Tap 0.066NS
				RO/Tap 3.081*
Total hardness	170.5±132.8	542±10.95	204±71.76	RO/Boring 0.141NS
				Boring/Tap 22.94NS
				RO/Tap 1.015NS
Chloride	95±96.32	160±151.8	148.4±59.13	RO/Boring 0.079NS
				Boring/Tap 1.523NS
				RO/Tap 2.173NS
Alkalinity	48.5±143.9	80±58.7	218.8±95.40	RO/Boring 1.649NS
				Boring/Tap 4.275*
				RO/Tap 1.879NS
Fluoride	2.8±1.90	3.6±1.9	2±1.59	RO/Boring 0.824NS
				Boring/Tap 1.723NS
				RO/Tap 1.505NS
Nitrate	23.25±14.71	8.4±10.59	23.2±10.49	RO/Boring 2.573NS
				Boring/Tap 2.855NS
				RO/Tap 0.012NS

Note: * indicate significance of value at P=0.05, NS = Non-significant

Table 2 : Comparison of different parameters of drinking water with WHO standards

Parameter	WHO standards (mg / lit.)	RO water (Mean value)	Boring water (Mean value)	Tap water (Mean value)
pH	7.0 – 9.5	7.325	7.5	8.1
Total hardness	500	170.5	542	20.4
Chloride	Upto 250	95	160	148.4
Alkalinity	Upto 500	148.5	80	218.8
Fluoride	Upto 1.0	2.8	3.6	2
Nitrate	10 mg / lit.	23.25	8.4	23.2

this study strengthened the hypothesis the magnesium in drinking water. Helps to prevent death from cerabrovascular disease (Yang *et al.*, 2009).

Chloride :

In RO water the mean level of chloride was 95mg/lit. in comparison to tap water and boring water which had a level of 148.4 mg/lit. or 160 mg/lit., respectively. WHO has given the standard of 250mg/lit. chloride. According to WHO standards the RO, boring and tap water were safe for drinking. Dun and Mel (2002) revealed that chlorination of drinking water was associated with an increased incidence of cancer of the colon and rectum (Dun and Mel, 2002).

Alkalinity :

The mean alkalinity of boring water was lower *i.e.* 80mg/lit. In comparison to RO and tap water. This had a higher mean alkalinity of 148.5 mg/lit. and 218.8 mg/lit., respectively.

Fluoride :

The mean fluoride level of tap, RO and boring water were 2 mg/lit., 2.8 mg/lit. or 3.6 mg/lit., respectively which were in the permissible un safe limits *i.e.* 1.0 mg/lit. as recommended by WHO. Choubisa (2006) in Dungarpur district of Rajasthan revealed on overall 70.0 and 82.9 per cent prevalence of dental flurosis in children and adults, respectively. The prevalence of skeletal flurosis in adults was 32.5 per cent (Choubisa, 2006).

Nitrate :

Safe levels of nitrate as recommended by WHO are 10 mg/lit. none of the water sample had a nitrate level in the safe limit. The mean nitrate level of RO, boring and tap water were 23.25 mg/lit., 8.4 mg/lit. and 23.2 mg/lit., respectively.

Par *et al*. (2004) They tested the hypothesis of an association between childhood type 1 diabetes risk and nitrate concentration in drinking water in Sardinia, Italy, using poisson regression analysis. Childhood T_1D risk showed an inverse trend with increasing quartile of nitrate level in the total population and among men. A nitrate concentration in drinking water below 10 mg/lit is unlikely to account for the spatial variation in childhood type 1 diabetes incidence (Par *et al*., 2004).

Conclusion :

In present study all the RO and Tap water consuming diabetic subjects whose water hardness is 50-500mg/lit. within the WHO standards it is beneficial for diabetic subjects because calcium and magnesium present in water it help to prevent coronary heart disease (CHD) and diabetes. Only 10 per cent subjects who used boring water were at unsafe limit. 24 per cent subjects drink water pH below 7. It is advisable to diabetic patients to use water whose pH is more than 7.

Good quality water chloride range up to 250mg/lit. 94 per cent subjects were in the chloride range of 50-250 mg/lit.and only 6 per cent subjects drink water chloride range were above 250 mg/lit. Out of 50 diabetic subjects 66 per cent used fluoride rich water in the range of above 1.0 mg/lit. and only 34 per cent of subjects used water of fluoride level of upto 1.0 mg/lit.

Diabetes has been treated very successfully using alkaline water. If we prevent wastes from accumulating by means of alkaline water, the person will not get diabetes. Present study shows that 48 per cent diabetic subjects used alkaline water in the range of 40-140 mg/lit. and 26 per cent used water alkalinity in the range of 340-440 mg/lit.The normal nitrate level is 10 mg/lit. in present study only 14 per cent subjects were in safe limit and 86 per cent subjects were at unsafe level. High fluoride contain are harmful for diabetes and these subjects could not used high fluoride water. Tap water is recommended for diabetic subjects as it has more pH, alkalinity and less chloride, fluoride and nitrate (harmful) then RO and boring water.

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